

interest, and the third is difficult to follow in parts except by readers having some acquaintance with the subject. Probably the work will be best read and appreciated by readers who have already acquired a rudimentary knowledge of scientific principles and desire to know something of the problems and positions of branches of natural knowledge beyond the boundary of their own experience.

A sectional model of the frog, showing the external and internal parts of the animal, and its development from the fertilised egg to the stage in which the tail of the tadpole has nearly disappeared and the hind- and fore-legs are present, is presented with the second volume. The model should be of assistance in suggesting instructive observations to the student or teacher of natural history.

When the work is completed it will form a very useful compendium of pure and applied science, and should find a place on the shelves of many libraries. The editor is to be congratulated upon the plan, and the publishers upon the attractive form in which they have executed it.

THE EXPERIMENTAL METHOD IN ZOOLOGICAL RESEARCH.

Experimental Zoology. Part i., Embryogeny: an Account of the Laws governing the Development of the Animal Egg as ascertained through Experiment. By Dr. Hans Przibram. Pp. viii + 224; 16 plates. (Cambridge: University Press, 1908.) Price 7s. 6d. net.

THE publication of a new work on experimental zoology is a sign of the times. Until comparatively lately the experimental method was not widely adopted in the pursuit of zoological inquiry. The morphologist, as a general rule, confined his attention to the form and structure of animals and the changes through which these pass in the progress of individual development, without regard to the different ways in which form and structure arise in embryogeny and the forces which control the modes of growth.

The founding of the *Archiv für Entwicklungsmechanik* was a new departure in serial zoological literature, and served to emphasise the growing importance of that branch of study which is called developmental mechanics, while the subsequent issue in America of a new journal, *The Journal of Experimental Zoology*, in which the range of subjects discussed is somewhat more extensive, was a further advance in the recognition of the experimental method as a means of zoological research. Still more recently Prof. T. H. Morgan has published a volume on "Experimental Zoology" in which he deals not only with problems of animal morphology, but with others which are in their essential nature physiological. But physiology, as ordinarily understood, still tends to signify human physiology, and the study of function in the lower forms of life, excepting in so far as it serves directly to elucidate the vital processes of the higher animals, and more particularly

man, remains as yet a much neglected department of biology.

Experimental zoology may be held to comprise all those branches of zoological inquiry, whether morphological or physiological, which are conducted by observation combined with experiment. That the fundamental problems in biology cannot be solved without recourse to the experimental method is a generalisation which zoologists have been a little slow to accept, and the complete absence in this country (and, indeed, in nearly every country) of experiment stations where animals can be kept under constant observation in a natural and healthy environment is a circumstance which contrasts strangely with the comparative wealth of equipment in other branches of observational science. It is greatly to be hoped, therefore, that the appearance of such works as Dr. Hans Przibram's, which is to treat of all departments of experimental zoology, will be the means of compelling greater attention to the pressing needs of this branch of study.

We are told in the preface that the work is to be issued in five parts, each of which is to be complete in itself. The present volume deals with fertilisation and the first development of the individual organism without regard to its origin; the phenomena of regeneration are to be discussed in part ii.; variation and heredity in part iii.; the growth of the developed organism and the relation between the cell nucleus and the cytoplasm in part iv.; while the last volume is to be devoted to general physiological problems, including that of sex. The part now under notice is an English translation by Miss Hertha Sollas of a German edition published last year.

We are informed at the end of the preface that "the author has read the proofs [of the translation] and has made such additions as were necessary to bring it up to date." Nevertheless, we cannot refrain from remarking on the absence of any reference to several not unimportant papers that have appeared in recent years, and in our opinion the first chapter is calculated to convey a wrong impression of the present state of the fertilisation problem. Thus it is recorded that Winkler succeeded in fertilising sea-urchin ova with the extracted juice of spermatozoa, but there is no mention of the subsequent work of Gies (published so long ago as 1901), which showed that Winkler's results were due to osmotic influences, and not to the action of the sperm extract. Gies's interpretation has since been accepted by Loeb, while Pichou's results (published in 1905) were confirmatory of those of Gies. There is at present no experimental evidence that spermatozoa contain specific substances which, when extracted, are capable of fertilising ova. Again, in the italicised conclusion at the end of the first chapter we read that

"the cause which determines the transition of the resting animal egg cell to a state of progressive development must be sought in an acceleration of the vital processes which, even in the resting egg, are always going on."

Loeb, however, has pointed out (1906) that if such a conclusion were correct, normal sea-urchin eggs

should segment if kept for a sufficiently long period, and, further, that it ought to be possible to induce segmentation by heat, since heat is known to accelerate chemical reactions, but neither of these results could be obtained. Loeb has suggested, therefore, that the spermatozoon, in conjugating with the ovum, may very possibly remove from the latter a negative catalyser or condition, the presence of which in the ovum somehow inhibits the process of development. Strangely enough, the present work contains no account of Loeb's conclusions in regard to this matter.

Delage's recent paper (1907) is referred to in a couple of lines, but there is no mention of the fact that his latest method of artificially fertilising sea-urchins' eggs differs radically from those employed by Loeb, and consequently there is no reference to the very important conclusions which Delage deduces from his results. Moreover, we should have expected an allusion to the fact that the symmetry of the sea-urchins which Delage succeeded in rearing was hexamerous instead of pentamerous, an observation which seems to us to have an important bearing on recent Mendelian research and teaching. Furthermore, the statement on another page that Delage has described half the ordinary number of chromosomes for parthenogenetic echinoderms is misleading, since this author says distinctly that in such cases the normal number becomes restored by a process of "auto-regulation."

The account given of fertilisation is followed by interesting chapters on egg-structure, mitotic cell division, gastrulation, the mechanism of the development of differentiation, and the influence of external factors. We have no space left in which to criticise these. Although we have not refrained from pointing out certain shortcomings, this does not prevent us from congratulating both author and translator on the production of what is, on the whole, a very useful summary of embryogenetic research.

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MODERN PHARMACOGNOSY.

Handbuch der Pharmakognosie. By Prof. A. Tschirch. Parts ii. to viii. (Leipzig: Chr. Herm. Tauchnitz, 1908.) Price 2 marks per part.

THE general scheme of this important work on pharmacognosy having been described in a previous issue of NATURE (vol. lxxviii., p. 629, October 22, 1908), the manner in which the scheme is being carried out may now be examined.

The bulk of the first four parts, in all about 116 pages, is devoted to "pharmacoergasy," that is, the cultivation, collection, and preparation of drugs. Numerous instances, perhaps not very systematically arranged, of the cultivation of drugs in remote ages are cited, and accounts are given of modern attempts to acclimatise important medicinal plants. The great problem of pharmacoergasy is, according to the author, the determination, not only of the conditions of growth simply, but also of those conditions that most conduce to the formation of valuable constituents, a

problem which presents a boundless field for investigation. The irrationality of a number of the processes at present in use for drying drugs is indicated, and suggestions made for their improvement.

The times at which leaves and other organs should be collected are stated in general terms, but doubt may well be expressed whether these are not in several, perhaps many, instances incorrect; at least they have not been sufficiently substantiated either by chemical or biochemical assay. To allude to definite instances, it has recently been well established by the physiological experiments of Dixon supporting the assays of Fromme that the first year's leaves of the foxglove are practically of equal value with the second year's, although Prof. Tschirch would reject them as worthless. Chemical assay has also demonstrated the practical equality of the first and second year's henbane leaves, and probably also those of the annual plant were the leaves only of the latter collected and properly dried. Even the best period for the collection of aconite and belladonna cannot yet be regarded as firmly established. Schroff may well have been the first to indicate the time at which hemlock fruits should be gathered, but the admirable researches of Farr and Wright determined the point definitely by analysis.

In this section enzymes and their influence are considered, though perhaps more emphasis might be laid on their prejudicial action, and on the means now generally advocated and adopted for obviating it. A most comprehensive list of the plants cultivated in Europe and the United States is included in this part of the work, as well as a chapter on the collection of drugs, well illustrated by a number of photographs. The preparation of drugs is discussed at some length, and consists practically of well-known processes which are commonly given under each drug, but are here collected together.

Part iv. deals with "pharmacoemporia," or the commerce in drugs, a section of pharmacognosy which has until lately been only too much neglected, though of the greatest interest. Here the various routes that commerce between the East and the West has taken from ancient to modern times are briefly, though not too lucidly, traced and explained by three maps. Excellent accounts are given of the drug sales in London, Hamburg, and Amsterdam, those in London being accompanied by several illustrations identical with those first published in the *Pharmaceutical Journal* by Mr. Heap, an acknowledgment for which has doubtless escaped the author. Photographs of the most important harbours of the world illustrate this section of the work.

The commercial varieties of drugs and the packages in which they are exported form the chief subject of part v. In part vi. the advantages and disadvantages of the various pharmacognostical systems of classification that have from time to time been proposed are fully discussed, the author being in favour of one based upon the chemical relationships of the chief constituents, though he admits that such a system is at present impracticable, as the constitution of so few of the constituents is sufficiently well known. For all teachers of pharmacognosy the